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Original communication

Knowledge attitude and practice of pesticide use among agricultural workers in Puducherry, South India

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ABSTRACT

Objectives: To study the level of knowledge and practice related to pesticides and their adverse effects among agricultural workers.
Materials and methods: A cross sectional study among 100 randomly selected agricultural workers, using or ever used pesticide within last one year was conducted in Puducherry, South India. The questionnaire was adapted from WHO field surveys of 'Exposure to Pesticides Standard Protocol' and similar studies. Data were collected by face to face interview.
Results: All the participants were male with mean age of 54.3 yrs. While 70% of respondents perceived pesticide spraying affects a person's health, only 40% were aware that it affects the environment. Two thirds of the respondents (62%) were aware that pesticide enters the body through nose and affects lungs. Awareness on other modes of entry was less. Majority (76%) of them was aware of training programs conducted by government agriculture department on pest management. About 42% of farmers had good knowledge regarding pesticide. Between 40% and 70% of respondents were not using any protective equipments during pesticide spraying. Around 68% of farmers indiscriminately disposed empty containers while 48% buried the leftover pesticides. Significant association ($p < 0.05$) was observed between knowledge of the farmers and their practices related to pesticides.
Conclusion: Overall awareness of agricultural workers on pesticide was inadequate. Improper disposal of pesticides and its container can produce harm to the environment. The findings of the study emphasize the need to educate agricultural workers regarding safe and adequate use of pesticides to prevent health and environmental hazards.

1. Introduction

Agriculture is the largest sector in South India for generating crops. Agricultural workers (farmers) use pesticides to kill insects, fungi, rodents and other organisms to protect the crop production and preservation of food materials. According to World Health Organization report, 20% of pesticides manufactured in world market are used in developing countries.[1] Unsafe use of pesticides in these countries has been reported in earlier studies.[2,3] These unsafe practices can have detrimental effects on human health.[4] They can be acutely manifested as headache, rashes, disorientation, shock, nausea, vomiting, respiratory failure and even death.[4–6] Long term effects of unsafe use can result in reproductive, neurologic and skin diseases.[7–10] Other harmful effects include alopecia, pulmonary edema, and bronchopneumonia and muscle spasm.[11]

The practice of pesticide use varies from one region to another, based on the knowledge of the local population

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regarding the poisonous properties of these compounds. Farmers in rural Mexico have the habit of tasting pesticides to quantify dilution.[12] A study in Palestine has documented significant correlation between knowledge and use of protective measures among agricultural workers.[13] As there are no previously published studies on assessment of level of knowledge, practice of pesticide use and their association, among farmers in South India, this study was carried out. The findings of the study could provide a background for planning educational strategies for agricultural workers to protect them from pesticide related occupational hazards.

2. Materials and methods

This was a population based cross sectional study among farmers actively involved in agriculture. The study was carried out during February and April 2012, after obtaining clearance from Institutional Ethics Committee of a Medical College. Seven rural areas (villages) of Puducherry in South India were randomly selected. All these villages had identical socio cultural environment. The major occupation in these villages was agriculture. The major crops grown were rice and sugarcane. The informal leaders of these villages were sensitized about the nature of the study. A list of farmers was generated from the information provided by these leaders. It was decided to interview 15 eligible farmers (age >18 years and who were using or ever used pesticides within last one year), selected at random from this list in each village.

The instrument used was a structured questionnaire which was developed based on WHO field survey of Exposure to Pesticides Standard Protocol[14] and from similar published studies.[13,15–17] The questionnaire contained three sections. The first section consisted of demographic details like age, sex, educational status etc. The second section had eight questions to assess knowledge of respondents about pesticides. The responses were documented as 'yes', 'no' or 'don't know'. For each 'correct' response, a score of '+1' was awarded. For 'wrong' answer, a score of '−1' and for 'don't know', a score of '0' was given. A score of 4 or more was considered as good knowledge and less than 4 as poor knowledge.[13] The third section consisted of questions related to practice such as use of personal protective equipments during spray, taking food or drinking water during application of pesticide, bathing after application of pesticide, disposal of leftover pesticide/empty pesticide containers etc.

Data were collected by face to face interview from the selected farmers after informed consent. The data were entered in MS-Excel spread sheet and then analyzed by appropriate statistical procedures (chi-square test). Observed results were expressed in frequencies, and percentages for specific variables, and as mean ± SD for continuous variables. p values of less than 0.05 were accepted as statistically significant.

Table 1
Knowledge of farmers about health effect of pesticide ($n = 100$).

	Correct	Incorrect	Don't know
Pesticides affect human health	70	18	12
Pesticide enter into the body through skin	41	19	40
Pesticide enter into the body through mouth	38	24	38
Pesticide enter into the body through nose	62	15	23
Pesticides affect livestock	36	44	20
Pesticides affect environment	40	35	25
Training conducted by Govt. agency	76	4	22
Pesticide affect soil fertility	26	41	33

Table 2
Association between knowledge with educational level and source of pesticide knowledge.

Variable	Good knowledge[a] ($n = 42$)	Poor knowledge[a] ($n = 58$)	Total ($n = 100$)	χ^2 value p value
Educational level				
Illiterate	0	16 (27.6%)	16	20.08
Primary	6 (14.3%)	16 (27.6%)	22	<0.001
High school	28 (66.7%)	20 (34.5%)	38	
College	8 (19%)	6 (10.3%)	14	
Source of pesticide knowledge				
Govt. agency	19 (45.2%)	26 (44.8%)	45	8.79
Seller	17 (40.4%)	11 (18.96%)	28	<0.05
Media	6 (14.3%)	19 (32.75%)	25	
Friends	0	02 (3.4%)	02	

[a] The knowledge score was categorized as: <4 poor knowledge; and ≥4 good knowledge.

3. Results

A total of 100 male farmers participated in the study. The mean age of the respondents was 54.3 years (SD = 8.2). Nearly two third of them had completed high school level education. Majority (70%) perceived that pesticides affect human health. However, three fifth of the respondents were unaware or had wrong belief about effect of pesticides on livestock and environment. Sixty two percent of farmers were aware that pesticides enter into human body through nose and affect lungs. Only two fifth were aware about skin as a route of entry for pesticides [Table 1]. Overall, only 42 farmers have good knowledge (mean score = 5, SD = 0.64) and rest 58 had poor knowledge (mean score = '1.9', SD = 0.67) Significant association ($p < 0.05$) was observed between good knowledge and level of education [Table 2]. Forty five percent farmers got information on pesticides from Govt. Agriculture Department.

Non-use of personal protective equipments during pesticide spraying varied between 40% and 78%. There was a significant association between use of protective equipments and knowledge of the farmers [Table 3]. Nearly 2/3rd of the farmers reported that they do not consume anything during spray and 63% of farmers reported washing clothes worn during pesticide spray [Table 3]. Nearly half of the farmers disposed leftover pesticide by burying. One third of the farmers disposed leftover pesticide in the field. Majority of the

Table 3
Association between knowledge and selected practices.

Practice	Use	Good knowledge ($n = 42$)	Poor knowledge ($n = 58$)	Total ($n = 100$)	χ^2 value & p value
Use of personal protective equipments					
Face mask	Yes	33 (78.6%)	22 (37.9%)	55	16.25
	No	9 (21.4%)	36 (62.1%)	45	<0.001
Gloves	Yes	8 (66.7%)	18 (31%)	46	12.45
	No	14 (33.3%)	40 (69%)	54	<0.001
Eye mask	Yes	12 (28.6%)	13 (22.4%)	25	0.49
	No	30 (71.4%)	45 (77.6%)	75	>0.05
Spl. shoes	Yes	14 (33.3%)	8 (13.7%)	22	5.42
	No	28 (66.7%)	50 (86.3%)	78	<0.02
Spl. clothes	Yes	33 (78.6%)	26 (44.8%)	59	11.46
	No	9 (21.4%)	32 (55.2%)	41	<0.001
Hat	Yes	16 (38.1%)	16 (27.6%)	32	1.23
	No	26 (61.9%)	42 (72.4%)	68	>0.05
Consuming food and drink during spray					
Food/drink	Yes	06 (14.3%)	27 (46.5%)	33	14.91
	No	36 (85.7%)	31 (53.5%)	67	<0.001
Removal of clothes for washing					
Clothes removal	Yes	33 (78.6.%)	30 (51.7%)	63	5.965
	No	9 (21.4%)	28 (48.3%)	37	<0.02

Table 4
Association between knowledge and pesticide disposal practices.

Mode of disposal	Good knowledge ($n = 42$)	Poor knowledge ($n = 58$)	Total ($n = 100$)	χ^2 value p value
Leftover pesticide				
Local waste container	4 (9.5%)	0	4	13.925 $p < 0.005$
Storing for reuse	6 (14.3%)	8 (13.8%)	14	
Burying	25 (59.5%)	23 (39.6%)	48	
Pour in the field	7 (16.7%)	27 (46.7%)	34	
Disposal of empty container				
Throw indiscriminately	21 (50%)	47 (81%)	68	24.243 $p < 0.001$
Burial	12 (28.5%)	2 (3.4%)	14	
Burning	5 (11.9%)	2 (3.4%)	7	
Washing and reusing	2 (4.8%)	6 (10.3%)	8	
Others	2 (4.8%)	1 (1.7%)	3	

farmers reported indiscriminate disposal of the empty container. Farmer who disposed by burial or burning mostly belongs to good knowledge category. Significant association was observed between knowledge level and safe disposal practices of pesticides by the farmers [Table 4]. Irrespective of category, all the farmers took bath after pesticide application. Around 66.7% of farmers with good knowledge immediately used the pesticide after buying it. Whereas 62.1% of farmers with poor knowledge of immediately using it. The pesticide was stored either in a special storage area or house by 38% of farmers out of which majority (57.89%) had poor knowledge.

4. Discussion

In this study, we assessed the farmer's level of knowledge and its association with practice of pesticide use. Education influences knowledge. This was evident from our study as well as in a study at Palestine by Sa'ed et al., where significant association was reported between good level of knowledge about pesticide and education level.[12] The educational background of the farmers in our study was 66.7% up to high school level. In our study, majority of the farmers was aware that pesticides affect human health and enter the body through nose. Similar findings were revealed in Gaza study.[18] Information from government agency reflected in good knowledge level among the farmers. This finding was consistent with the study by Sa'ed et al.[12] Other sources of information of pesticides such as sales point or friends etc. reported in the present study were consistent with a study by Eva Nalwanga et al. at Uganda.[19]

Our study observed that farmers with good knowledge used more protective measures compared to farmers with poor knowledge. Findings were consistent with the study by Sa'ed et al.[12] A study by Reena MC et al., at Brazil reported that less than 20% of farmers used mask, impermeable clothes, or gloves during pesticide application.[16] A study by Mekonnen Y et al., has reported that 18% sprayers had unfit goggles and 29% used worn-out gloves.[15] In this study, nearly 80% of farmers with good pesticide knowledge washed their clothes after pesticide spray, whereas in the study by Sa'ed et al., 68.5% reported washing contaminated clothes.[12] Our study observed that, while most of the farmers (66%) buy and use the pesticide immediately, one third farmers had special storage area for the pesticides and very few (4%) stored them at home. Sa'ed et al.[12] reported in their study that only 7.3% buy and use it immediately. In their study, storage of pesticide products at home was (19.2%), at specific store (53%), at animal house (8.7%) and at farm site was (11.8%). In our study, although only 4% of farmers store pesticide at home, this practice could put other family members at risk.[18] In our study, nearly half of the farmers disposed leftover pesticide safely i.e. burying and one third of the farmers disposed the leftover pesticide by pouring into the field. Sa'ed et al. reported from their study that majority (60.9%) used the leftover pesticide solutions on the same day and 29.4% kept the leftover pesticide in a drinking container for later use.[14] The practice of pouring the leftover pesticide into the field in our study can be correlated with the knowledge, where three fourth of the farmers were ignorant about excess of pesticide affecting soil fertility. More than two third farmers adopted unsafe practice of disposal of empty containers as seen in this study. Similar findings were observed in the study at Dhading district, Nepal.[20] Sa'ed et al. reported disposal of empty pesticide containers by burning in 50% cases, by burying 7.6%, by washing and reusing at home 10% and reuse for storage of other pesticide 14.4%.[12] Similar findings were also reported in other studies.[16–18] This unsafe disposal could put general population at higher risk. This unsafe practice disposing leftover pesticide and empty pesticide container seen in our study is a concern because it produces impact on environment by contaminating soil, surface and ground water and also poses risk to non-target organisms. In the present study, all the farmers took bath after pesticide spray. A study in Howrah[21] reported only 37% of farmers taking bath after pesticide use. However, all the farmers washed their hand after pesticide spray.

5. Conclusion

The findings of the study indicate that knowledge level is inadequate among farmers. It influences the practice of farmers. There is a need for continuous pesticide safety education with training to the farmers regarding use of personal protective devices, personal hygiene and sanitation practices during and after spray. Present study was conducted over limited number of farmers. Further studies are needed in large scale to corroborate above findings.

Ethical approval
Ethical approval was obtained from institutional ethical committee.

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Conflict of interest
None.

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